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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/841,044	04/25/2001	Tsuneyuki Hagiwara	206584US2	4351

22850 7590 09/08/2003

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EXAMINER

STOCK JR, GORDON J

ART UNIT PAPER NUMBER

2877

DATE MAILED: 09/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/841,044

Applicant(s)

HAGIWARA ET AL.

Examiner

Gordon J Stock

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 and 44-63 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6, 8, 13, 23, 24, 44-51, 54, 56-63 is/are rejected.
- 7) ☒ Claim(s) 5, 7, 9-12, 14-22, 52, 53 and 55 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 October 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: ____

DETAILED ACTION

Drawings

1. The drawings and specification are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 217 of Fig. 44; P of Figs. 2-6, 40 and 41; RI of Fig. 23; S and WZ of Fig. 31. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.
2. The drawings are objected to because Figs. 33a, 33b, 34a, 34b, 35a, 35b, 36a, and 36b lack labeled axes. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3. The abstract of the disclosure is objected to because it exceeds 150 words. Correction is required. See MPEP § 608.01(b).
4. The specification is objected to for the following: on page 132 lines 11 and 13 read – exposure apparatus 10--. They should read –exposure apparatus 110--. Correction is required.
5. The specification is objected to for the following: on page 66 line 4 the abbreviation, SMP, is not defined; on page 63 lines 5 and 9 the abbreviation, AIS, is not defined. Corrections required.

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6. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

7. **Claim 55** is objected to for the following: the terms "said aerial measurement unit" and "said driving unit" lack antecedent basis. Correction is required.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. **Claims 8, 13, 59-61** are rejected under 35 U.S.C. 102(b) as being anticipated by **Ota (WO99/45581)** (citations from translation of detailed description).

As for **claims 8, 13, 59-61**, Ota discloses the following: illuminating a predetermined mark with an illumination light and forming an aerial image of said mark on an image plane via said projection optical system; scanning a pattern forming member, which has at least one slit-shaped aperture pattern with a predetermined slit width extending in a first direction within a two dimensional plane perpendicular to an optical axis of said projection optical system and photoelectrically converting said illumination light having passed through said aperture pattern and obtaining a photoelectric conversion signal which corresponds to an intensity of said illumination light; obtaining optical properties of said projection optical system; forming of said aerial image and detection of said photoelectric conversion signal repeatedly performed at

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different positions, and based on plurality of photoelectric conversion signals and at least one of a distortion and a magnification is obtained; measuring optical properties of projection system; adjusting projection system based on results; transferring pattern onto substrate using adjusted projection system (pages 17, 21-24).

10. **Claims 51, 54, 56, 57, 58, 63** are rejected under 35 U.S.C. 102(b) as being anticipated by **Taniguchi (JP 11045846)** (citations from translation)

As for **claims 51, 54, 56-58 and 63**, Taniguchi in a scanning type exposure method discloses the following: a self-measurement master on which a plurality of types of measurement marks are formed, a reticle with mark and FRM's; a self-measurement master mounting stage, a reticle stage that can move close to a focal position where said illumination light can illuminate; wherein master is a mask with predetermined pattern; reticle includes at least one of a distortion measurement mark; the marks may be an isolated line mark and line and space mark; wherein exposure is performed (paragraphs 13, 19-21, 25-28, 31)

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. **Claims 1-4, 6, 23, 46-50, 62** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ota (WO99/45581)** (citations from translation of detailed description) in view of **White (6,379,868)**.

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As for **claims 1-4 and 6**, Ota discloses the following: illuminating a mark with illumination light and forming an aerial image of mark; scanning a pattern forming member, which has at least one slit-shaped aperture pattern extending in a first direction within a two-dimensional plane perpendicular to an optical axis of said projection optical system; photoelectrically converting illumination light having passed through said aperture pattern and obtaining a photoelectric conversion signal which corresponds to an intensity of said illumination light (page 17, pages 22-24). As for the slit having a width set in consideration of a wavelength or numerical aperture Ota is silent, but discloses the resolution as being related to the numerical aperture and wavelength (page 1). White in a lithographic process teaches that the ability of a feature to be resolved depends on the numerical aperture and wavelength (col. 5, lines 55-60). Therefore, it would be obvious to one skilled in the art at the time the invention was made that the width would be set in consideration of wavelength and numerical aperture, for the resolution of a feature such as a width of pattern depends on the numerical aperture and wavelength. As for the width being under the wavelength divided by the numerical aperture, or .8 of the previous value, or half of the wavelength divided by the numerical aperture, White discloses a blurred image occurs between a quarter and one half of the wavelength divided by numerical aperture (col. 5, lines 55-63). Therefore, it would be obvious to one skilled in the art to have the width at least one half of the wavelength divided by the numerical aperture in order to be resolved.

As for **claim 23**, Ota discloses everything as above (see **claim 8**). Ota discloses the resolution as being related to the numerical aperture and wavelength (page 1). White in a lithographic process teaches that the ability of a feature to be resolved depends on the numerical aperture and wavelength (col. 5, lines 55-60). Therefore, it would be obvious to one skilled in

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the art at the time the invention was made that the width would be set in consideration of wavelength and numerical aperture, for the resolution of a feature such as a width of pattern depends on the numerical aperture and wavelength.

As for **claims 46-49**, Ota discloses the following: an illumination unit which illuminates said mark to form an aerial image; a pattern forming member, which has at least one slit-shaped aperture pattern extending in a first direction within a two dimensional plane perpendicular to an optical axis; a photoelectric conversion element; a processing unit which scans said pattern forming member and measures a light intensity distribution corresponding to said aerial image; a calculation unit which calculates optical properties; a substrate stage; pattern forming member integrally movable with said substrate stage; wherein said exposure apparatus comprises a control unit which measures a light intensity distribution corresponding to aerial images of mark patterns and obtains optical properties of projection system (page 17, pages 22-24).

As for the slit having a width greater than zero and equal to or under wavelength divided by numerical aperture, Ota is silent, but discloses the resolution as being related to the numerical aperture and wavelength (page 1). In addition, White in a lithographic process teaches that the ability of a feature to be resolved depends on the numerical aperture and wavelength (col. 5, lines 55-60). Therefore, it would be obvious to one skilled in the art at the time the invention was made that the width would be set in consideration of wavelength and numerical aperture, for the resolution of a feature such as a width of pattern depends on the numerical aperture and wavelength.

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As for **claim 50**, Ota in view of White discloses everything as above (see **claim 48**). In addition, Ota discloses a mark detection system, which detects a position of a mark on said substrate stage and control unit, judgment unit (lines 15-40 of page 10)

As for **claim 62**, Ota in view of White discloses everything as above (see **claim 48**) and exposure is performed (line 49 of page 21)

13. **Claims 24 and 44** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Mori et al. (5,594,549)**.

As for **claim 24**, Mori discloses the following: illuminating a first mark in a state where said first mark is positioned at a first detection point within an effective field of said optical projection system to form an aerial image of said first mark, and measuring a light intensity distribution corresponding to said aerial image and photoelectrically converting light via said measurement pattern from a stopper; illuminating a second mark in a state where said second mark is positioned at a second detection point within an effective field of said optical projection system to form an aerial image of said second mark, and measuring a light intensity distribution corresponding to said aerial image and photoelectrically converting light via said measurement pattern from a stopper; obtaining a positional relationship between first image forming position of said aerial image of said first mark within a plane perpendicular to said optical axis obtained by a result of said measurement of said aerial image of said first mark and a second image forming position of said aerial image of said second mark (col. 7, lines 50-60; col. 8, lines 1-35).

As for scanning Mori is silent, but does show spatial frequency in regards to a direction (Figs. 3a-3c). Therefore, it would be obvious that scanning occurs for signals are obtained from movement in an x-direction. As for calculating telecentricity, Mori is silent, but teaches

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calculating deviations of magnification of the system (col. 10, lines 50-67). It is well known that telecentricity relates to magnification deviation. Therefore, it would be obvious to one skilled in the art at the time the invention was made that telecentricity was calculated for magnification deviation was detected which relates to telecentricity.

As for **claim 44**, Mori discloses everything as above (see **claim 24**). In addition, he discloses the first mark and second mark are the same (Fig. 4b, Fig. 5).

14. **Claim 45** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Mori et al. (5,594,549)** in view of **White (6,379,868)**.

As for **claim 45**, Mori discloses everything as above (see **claim 24**). He also discloses the stopper having a width set in consideration of a wavelength or numerical aperture (col. 12, lines 40-45). In addition, White in a lithographic process teaches that the ability of a feature to be resolved depends on the numerical aperture and wavelength (col. 5, lines 55-60). Therefore, it would be obvious to one skilled in the art at the time the invention was made that the width would be set in consideration of wavelength and numerical aperture, for the resolution of a feature such as a width of pattern depends on the numerical aperture and wavelength.

Allowable Subject Matter

15. **Claims 5, 7, 9-12, 14-22, 52, 53, and 55** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and rewritten to overcome any objections as stated above.

As to **claim 5**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an aerial image measurement method "said width of said aperture pattern in

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said second direction is half a minimum pitch multiplied by an odd number, said minimum pitch being a pitch of a line and space pattern in a limit of resolution set by illumination conditions including properties of said illumination light and the type of said pattern”, in combination with the rest of the limitations of **claim 5**.

As to **claim 7**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an aerial image measurement method recovering original aerial image by performing an inverse Fourier transform on said spectrum distribution, in combination with the rest of the limitations of **claim 7**.

As to **claim 9**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an optical properties measurement method “said mark consists of a line and space mark” and the particular predetermined evaluation amount, in combination with the rest of the limitations of **claims 9-12**.

As to **claim 14**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an optical properties measurement method “said mark includes at least one rectangular pattern,” in combination with the rest of the limitations of **claims 14-16**.

As to **claim 17**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an optical properties method “said mark is a rectangular shape,” in combination with the rest of the limitations of **claims 17-18**.

As to **claim 19**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a properties measurement method “said mark consists of a line and space mark,” in combination with the rest of the limitations of **claims 19-21**.

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As to **claim 22**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an optical properties measurement method “said mark is a symmetric mark having at least two types of a line pattern with a different line width arranged in a predetermined interval in a direction corresponding to said second direction,” in combination with the rest of the limitations of **claim 22**.

As to **claim 52**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an exposure apparatus the particular aerial measurement unit, in combination with the rest of the limitations of **claim 52-53**.

As to **claim 55**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an exposure apparatus the particular control unit, in combination with the rest of the limitations of **claim 55**.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent 4,629,313 to Tanimoto

U.S. Patent 5,323,207 to Ina

U.S. Patent 5,914,774 to Ota

U.S. Patent 6,091,481 to Mori

U.S. Patent 6,114,072 to Narimatsu

U.S. Patent 6,313,916 to Inada

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Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

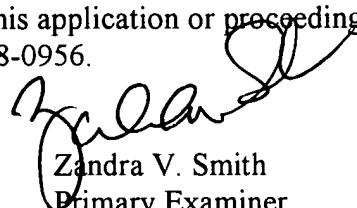
Papers related to the application may be submitted to Group 2800 by Fax transmission. Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The CP4 Fax Machine number is: (703) 308-7722

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (703) 305-4787. The examiner can normally be reached on Monday-Friday, 10:00 a.m. - 6:30 p.m.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

gs

August 20, 2003


Zandra V. Smith
Primary Examiner
Art Unit 2877